

REMARKS

In response to the Official Action mailed on September 22, 2010, the application has been amended. No new matter has been added. Reconsideration of the rejections of the claims is respectfully requested in view of the above amendments and the following remarks.

On page 4 of the Official Action, claims 9, 11 - 17, and 20 - 28 were rejected under 35 USC 103(a) as unpatentable over JP 62-259665 (referred to below as Kabe) in view of WO 03/048579 (referred to below as Gerstenberg). WO 03/048579 corresponds to U.S. Patent No. 7,165,933, so these remarks will refer to the U.S. version of Gerstenberg, as was done in the Official Action.

This rejection, which is essentially identical to the rejection made in the Official Action of March 16, 2010, is traversed because a person skilled in the art could not find any reason to combine the cited references in the manner proposed by the Official Action.

Kabe discloses a wave soldering apparatus having a pump 15 with a spiral screw 23 which is rotated by a motor 33 to discharge molten solder from a nozzle 18. Kabe does not teach or suggest a multiple-blade screw.

Gerstenberg discloses a screw pump for transporting

emulsions susceptible to mechanical handling. According to column 3, lines 65 - 67 of Gerstenberg, the number of blades in the screw pump is preferably in the range of 1 - 10, more preferably 1 - 6, and most preferably 2 - 5. The example shown in Figure 1 of Gerstenberg has two screw blades 11.

Column 5, lines 19 - 28 of Gerstenberg states that the screw pump is for the purpose of pumping any emulsion that is susceptible to mechanical or temperature damage and is particularly suited for pumping emulsions comprising oil or fat, water, and optionally a gas. Examples of such emulsions are dairy products, butter, margarine, margarine products, spread, mayonnaise, dressings, toppings, dough, creams, lotions, ointments, etc. Preferably the emulsion is a food.

According to page 5 of the Official Action, it would have been obvious to employ the multiple-blade screw pump of Gerstenberg with at least four helical blades in the device of Kabe "because the multiple-blade pump more efficiently and effectively transports the viscous liquid than would a single-blade pump".

As set forth at length in the amendment filed on August 16, 2010, the above-described argument made in the Official Action includes the following flaws:

- (a) There is no teaching or suggestion in either Kabe or

Gerstenberg that a multiple-blade pump more efficiently and effectively transports a viscous liquid than would a single-blade pump. Gerstenberg states that a screw pump having 2 - 5 blades is preferable to a screw pump having 1 - 10 or 1 to 6 blades, but why this is or might be the case is left unsaid, and there is certainly no basis in Gerstenberg for the assertion in the Official Action that this number of blades is more efficient and effective. For all a person skilled in the art could tell from the disclosure of Gerstenberg, 2 - 5 blades might be preferable in the mind of Gerstenberg simply because the numbers 2 - 5 were Gerstenberg's favorite numbers. The statement in the Official Action that at least four helical blades increases efficiency or effectiveness is unsupported by the references.

(b) Even if the use of 2 - 5 blades in Gerstenberg increased the efficiency and effectiveness of the pump of Gerstenberg, this circumstance would not teach a person skilled in the art what number of blades would be most efficient or effective in Kabe, because Gerstenberg and Kabe handle entirely different fluids. Kabe relates to a wave soldering tank for handling molten solder, and there is nothing in Gerstenberg to suggest that the properties of a screw pump for handling emulsions are in any way applicable to a screw pump for handling molten solder. Molten solder is not an emulsion, and none of the considerations set forth in Gerstenberg with respect to an emulsion, such as the need to handle it "in a gentle way without excessive influences of heat or pressure to the product" (column

2, lines 40 - 42 of Gerstenberg) are pertinent to the handling of molten solder. Gerstenberg remains nonanalogous art with respect to Kabe, and a person skilled in the art could not find any reason to combine Kabe and Gerstenberg in the manner proposed by the Official Action. As set forth in the amendment filed on August 16, 2010, there is a huge difference in the viscosities of the substances handled in Gerstenberg (food product emulsions) and in Kabe (molten solder). Column 3, lines 19 - 22 of Gerstenberg state that the viscosity of materials to be handled by its pump is higher than 100 cp, preferably higher than 500 cp, and most preferably higher than 1000 cp. As stated in the previous amendment, molten solder is a low viscosity material. For example, a Pb-Sn solder of approximately a eutectic composition, which historically has been the most widely used type of solder for soldering of electronic parts, has a viscosity of only around 2.7 cp. To a person skilled in the art, the vast difference between the viscosity of the emulsions being handled in Gerstenberg and the viscosity of the molten solder being handled in Kabe renders the disclosure of Gerstenberg of no relevance to the disclosure of Kabe.

Concerning the fact that Gerstenberg does not give any reason why the preferred number of blades of its pump is 2 - 5, page 2 of the Official Action argued that "Why Gerstenberg wants 2 - 5 blades is not of relevance to the combination, only the fact that he does."

The Applicants disagree with this assertion. A person skilled in the art is not a chimpanzee operating on the principle of "monkey-see monkey-do". If Gerstenberg can neither explain what is the advantage of 2 - 5 blades or under what circumstances that advantage occurs, a person skilled in the art could not know whether 2 - 5 blades in fact provides any advantage or whether this advantage would have any applicability to the pump of Kabe. The reason why one piece of prior art chooses a specific arrangement is of paramount importance to a person skilled in the art in deciding whether there is a reason to employ that arrangement in a different situation, such as to modify a different piece of prior art. Since Gerstenberg is silent about why 2 - 5 blades are advantageous, a person skilled in the art could not see any reason to modify Kabe to employ this number of blades.

Concerning the fact that the pump of Gerstenberg and the pump of Kabe are intended for use with fluids having totally different viscosities, the Official Action dismisses this difference as being of utterly no significance. Specifically, page 3 of the Official Action states that "Just because Gerstenberg uses his pump for particularly viscous material does not mean that Gerstenberg's pump wouldn't be used for less viscous materials".

On the contrary, the viscosity of the fluid being handled by a particular pump is of the utmost significance to a pump

designer in determining whether one pump is relevant to another pump, and the great difference between the viscosity of the fluid being handled by the pump of Kabe and the viscosity of the fluid being handled by the pump of Gerstenberg renders the teachings of Gerstenberg, such as they are, irrelevant to Kabe. Gerstenberg acknowledges as much in column 3, lines 17 - 18, which state that "As the person skilled in the art will appreciate pumping of a fluid depends on the rheological properties of said fluid". In other words, a pump that is suitable for a fluid of one viscosity is not necessarily suitable for a fluid of a different viscosity and different rheological properties. For this reason, a person skilled in the art would not find the pump disclosed in Gerstenberg to be pertinent to the pump disclosed in Kabe and could not find any reason to modify Kabe in the manner proposed by the Official Action.

The Official Action states several times (such as on pages 5 and 8) that the pumps of Kabe and Gerstenberg are analogous to each other because they both use screw pumps enclosed in cylindrical casings for forcing a viscous liquid through a pump to move it from one location to another. It is true that both references have a screw pump disposed in a cylindrical casing and that both force a viscous liquid through a pump to move it from one location to another, but these are trivial similarities. Almost every screw pump is enclosed in a cylindrical casing so as to force fluid to travel axially through the pump rather than simply being stirred around, and almost every pump has the

function of moving a fluid from point A to point B. As for the fact that both pumps handle a viscous fluid, this is basically the same as saying that both pumps handle a fluid, since almost any real fluid is a viscous fluid, meaning that it exhibits an internal resistance to flow. See, for example, "The Condensed Chemical Dictionary" (Tenth edition, 1981, page 1089) or "Elements of Physics by Alpheus Smith and John Cooper (McGraw Hill, 1972, p. 172) concerning viscosity. Water is a viscous fluid. Molasses is a viscous fluid. Air is a viscous fluid. Thus, the similarities between Kabe and Gerstenberg pointed out by the Official Action are essentially meaningless to a person skilled in the art, and a person skilled in the art dealing with a wave soldering device like that disclosed in Kabe would have no reason to see any relevance in Gerstenberg based on these minor similarities.

The bottom of page 8 of the Official Action states that "It would not be unreasonable to expect one of ordinary skill in the art at the time the invention was made to look to Gerstenberg to improve the pumping functions of solder tank impellers. More blades means that each blade has to do less work. It naturally follows that the pumping action would be improved". The Official Action does not identify the source of this theory of pump operation, but it is not one that the Applicants have heard of. As stated on page 3 and 4 of the declaration by Professor Charles Garris filed on August 28, 2010 in connection with the present application, increasing the number of vanes of a pump may

increase or decrease efficiency, and for a given working fluid, the optimum number of blades can be determined only by experimentation. As stated on page 4 of the declaration, it is not readily predictable whether the beneficial effects of an increased number of vanes and an increased number of turns on stability and a decrease in pressure fluctuations are outweighed by the beneficial effects of a reduced number of vanes and fewer turns. Therefore, the statement on page 8 of the Official Action that "It naturally follows that the pumping action would be improved" by adding more blades to the pump of Kabe is incorrect.

To summarize, as a person skilled in the could find no reason to combine Kabe and Gerstenberg in the manner proposed by the Official Action, the proposed combination of the references is unreasonable, and as such, the Official Action has failed to set forth a *prima facie* case of obviousness. Claims 9, 11 - 17, and 20 - 27 are therefore allowable. As stated below, claim 28 has been cancelled as redundant, so the rejection of claim 28 is moot.

In support of the allowability of the claims, a declaration under 37 CFR 1.132 showing unexpected effects of a wave soldering tank described by the pending claims is attached to this amendment. The declaration was prepared by Mr. Hirokazu Ichikawa, who is an employee of the assignee of the present application and who performed experiments comparing the performance of a 1-blade screw pump, a 2-blade screw pump, and a

four-blade screw pump. Of particular interest are the experimental results shown in the graphs labelled Exhibit B. In an experiment described beginning in the last paragraph of page 2 of the declaration, a soldering tank equipped with either a 1-blade screw pump or a 4-blade screw pump was operated at different rotational speeds, and the height of a solder wave discharged from a secondary nozzle of the soldering tank was measured with a laser displacement sensor. The rotational speed of the pump was instantaneously increased in increments of 5 Hz. The wave height of the secondary nozzle was measured continuously from before to after a change in rotational speed in order to observe the transient characteristics of the resulting wave. The first page of Exhibit B shows the results for a 1-blade screw pump, and the second page of Exhibit B shows the results for a 4-blade screw pump.

From a comparison of page 1 and page 2 of Exhibit B, it can be seen that at any rotational speed, the 4-blade pump produced a greater wave height than the 1-blade pump, and that when there was a step change in the rotational speed of the pumps, the solder wave stabilized in height far more quickly with the 4-blade pump than with the 1-blade pump. The difference in the length of time required for stabilization increased as the rotational speeds of the pumps increased. The wave height for the 1-blade pump sometimes took as long as 30 seconds to stabilize after a change of 5 Hz in the pump rotational speed, while the wave height for the 4-blade pump stabilized nearly

instantaneously when there was a change in pump rotational speed. As set forth in the declaration by Mr. Ichikawa, the greatly reduced time required for wave stabilization of a 4-blade pump compared to a 1-blade pump is a valuable feature of a 4-blade pump, since it means that more electronic parts can be soldered per minute when soldering is being carried out by a method (described in the declaration) in which the rotational speed of the pump and the resulting wave height is reduced to a minimum level between parts to be soldered.

The graphs shown in Exhibits A and B were previously submitted as part of the above-mentioned declaration under 37 CFR 1.132 by Professor Charles Garris which was filed on August 28, 2010. In that declaration, Professor Garris analyzed the graphs and stated that the results shown in Exhibit B are not predictable, since he did not know of any characteristic of screw pumps which would necessarily result in the phenomenon shown in the graphs.

Concerning the data shown in Exhibit B, page 3 of the Official Action states that the data are insufficient to show unexpected results because, according to the Official Action, "In order to show unexpected results, one must show a particular trend based on the number of blades, and then show that a four-blade pump defies what would normally be expected based on the trend, and instead creates a much improved product that is completely unexpected. Thus, more than two points per graph are

needed to show this trend and the expected results for a four blade pump."

The Official Action is relying on a nonexistent standard as to what constitutes unexpected effects. There is no rule that evidence of unexpected effects must be presented in a specific manner, and there is no *per se* rule that unexpected results can only be shown by comparing a series of data points. Unexpected effects are simply effects which are not predictable from the closest prior art cited by the Official Action, and any way of showing that the effects are not predictable will suffice. The closest prior art relied upon in the Official Action is the Kabe reference, which discloses a screw pump having only a single blade, and that is therefore the only art that it is necessary to make a comparison with in order to show unexpected effects.

As stated in MPEP 716.02(e)(III), "Although evidence of unexpected results must compare the claimed invention with the closest prior art, applicant is not required to compare the claimed invention with subject matter that does not exist in the prior art. *In re Geiger*, 815 F.2d 686, 689, 2 USPQ2d 1276, 1279 (Fed. Cir. 1987)". This same section of the MPEP further cites *In re Chapman*, 357 F.2d, 418, 148 USPQ 711 (CCPA 1966), where requiring the applicant to compare claimed invention with polymer suggested by the combination of references relied upon in the rejection of the claimed invention under 35 U.S.C. 103 "would be requiring comparison of the results of the invention with the

results of the invention".

since the closest prior art being relied upon in the present application is the wave soldering tank of Kabe, which has a screw pump with only a single blade, the Applicant only need compare a 4-blade screw pump with a 1-blade screw pump in order to show the unexpected effects of a 4-blade screw pump. As set forth above, the declaration by Professor Garris shows that the experimental results shown in Exhibit B of the declaration by Mr. Ichikawa are in fact unexpected. These unexpected results therefore provide further evidence of the nonobviousness of the invention described by claims 9, 11 - 17, 22, and 25, each of which describes a wave soldering tank with a screw-type pump having at least 4 helical blades.

Amended claim 20 is allowable for the reasons given above, i.e., because there is no basis for combining the references in the manner proposed by the Official Action, and it is further allowable in its own right. Amended claim 20 describes a wave soldering tank which includes a bowl-shaped guide having curved surfaces which are curved directly beneath the first and second openings of a partition. Namely, claim 20 not only states that the bowl-shaped guide has curved surfaces but identifies where curvature exists, i.e., directly beneath the first and second openings. Amended claim 20 is supported by Figure 5 of the drawings as filed, which shows curved surfaces 26 and 27 which are curved immediately beneath an inlet 3 and a through hole 7 in

a partition 6. Claim 20 has also been amended to delete the redundant language "having a multiple-blade screw-type pump" which was pointed out in the Official Action. The cited references do not disclose or suggest such an arrangement. The Official Action describe the bottom surface of the solder tank body 3 of the solder tank 2 of Kabe as having first and second curved surfaces, with each curved surface comprising the completely flat bottom plate 5 of solder the tank body 3, the completely flat side plate 13 or 14 of the solder tank 3, and a corner where the bottom plate 5 and the side plate 13 or 14 are welded to each other. The only portions of these "curved surfaces" which are possibly curved are weld fillets which possibly exist in the corners between the bottom plate 5 and the side plate 13 or 14, and if these weld fillets are in fact curved, they not curved directly beneath any of the openings in the plate 6 in Figure 1 of Kabe dividing the interior of the solder tank 2 into an upper and lower portion because they are not positioned directly beneath the openings. Therefore, the "curved surfaces" of Kabe referred to in the Official Action do not correspond to the curved surfaces set forth in amended claim 20. Therefore, even if Kabe and Gerstenberg were combined in the manner proposed by the Official Action, the combined references would not result in an arrangement having all the features set forth in amended claim 20. Claim 20 and claims 21 - 24, 26, and 27 which depend from it are therefore allowable. Of these claims, claim 26 has been slightly amended to describe the curved surfaces of claim 20 in a manner consistent with the description

of those surfaces in claim 20. Amended claim 26 is supported by Figure 5 of the drawings. The features of claim 28 have been incorporated into amended claim 20, so claim 28 has been cancelled as redundant.

Claim 24, which depends ultimately from claim 20, previously stated that in the wave soldering tank of claim 20, there were no obstructions to flow of fluid between the pump and the interior of the nozzle of the tank. Similarly, claim 25 described a wave soldering tank in which there was an unobstructed flow path between a casing and the interior of a nozzle. Page 7 of the Official Action states that these claims do not distinguish the present invention from Kabe because, according to the Official Action, there are no obstructions to flow of fluid between the pump and the interior of the nozzle in Kabe, despite the fact that in Kabe, molten solder must pass through a flow obstruction in the form of a baffle plate 50 having a large number of small holes 50a formed therein in order to enter a nozzle 18. According to page 9 of the Official Action, the baffle plate 50 of Kabe is not an obstruction because fluid can pass through it. The definition of "obstruction" and "unobstructed" employed in the Official Action is at odds with ordinary English usage. A flow path does not have to be completely blocked off in order to have an obstruction. For example, the terms "partial airway obstruction" and "complete airway obstruction" are commonly used in the medical field to refer to a partial or total blockage of a person's airway to the lungs. If an obstruction were only

something that completely closed off a passage, the term "partial airway obstruction" would be a contradiction, and the term "complete airway obstruction" would be redundant. There are also numerous U.S. patents which use the term "partial obstruction" in their claims, such as U.S. Patent No. 7,677,051 and No. 7,869,058, to give two random examples, which shows that an obstruction does not require complete blockage of a pathway. Therefore, it is incorrect to state that Kabe discloses an unobstructed flow path in light of the presence of the baffle plate 50. In fact, the very purpose of the baffle plate 50 is to provide an obstruction to flow and thereby reduce fluctuations in fluid pressure.

Page 9 of the Official Action states that if the Applicant wishes to claim the absence of a baffle, the Applicant should claim precisely that. Therefore, in order to expedite prosecution, claims 24 and 25 have been amended to state that there is no flow straightening plate between the pump and the interior of the nozzle of claim 24 or between the casing and the interior of the nozzle of claim 25. Amended claims 24 and 25 are supported by page 10 of the specification as filed, which states that a wave soldering tank according to the present invention renders flow straightening plates unnecessary. As the baffle plate 50 employed in Kabe is a form of flow straightening plate, even if Kabe were combined with Gerstenberg in the manner proposed by the Official Action, the combined references would not result in an arrangement having all the features set forth in

claims 24 and 25. These claims are thus allowable.

New claim 29 describes additional features of the present invention and is allowable as depending from claim 20.

In light of the foregoing remarks, it is believed that the present application is in condition for allowance. Favorable consideration is respectfully requested.

Respectfully submitted,



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Attachment

Declaration under 37 CFR 1.132 by Hirokazu Ichikawa

Certificate of Transmission

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Michael Tobias